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PUNCTURE OF THE FOOT, FOLLOWED BY TETANUS—SUBCUTANEOUS INJECTION—DEATH.

[Read before the Boston Society for Medical Observation, Jan. 7th, 1861, and communicated for the Boston Medical and Surgical Journal.]

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Nathan Jenkins, æt. 41, of rather spare habit, and nervous organization, regular in his habits, about 8½, A.M., Nov. 1st (Thursday), while working at his trade on a building, jumped down from a height of about five feet upon a board, through which a nail was sticking, and gave himself a punctured wound in the ball of the left great toe. By his own estimate, the nail went in an inch, and was with difficulty extracted. It produced most intense pain, extending from the wound over the whole body. From this time until noon, he was unable to procure a conveyance to take him to his boarding house in this city, and had nothing done except the application of a slice of salt pork, and a dose of brandy, neither of which mitigated his sufferings in the slightest degree. He was finally brought home in a chaise, completely chilled through, his teeth chattering, and his extremities cold.

2½, P.M.—Found him rolling in agony. Refers the pain to the puncture, with occasional flashes up the leg, and ending in the groin, where it was most excruciating. Mind wandering. Under this state of things, I proposed a consultation with Dr. Geo. H. Gay, who coincided in opinion to lay the puncture open by a free cut, which was accordingly done. A poultice, in which a quantity of tr. arnica was mixed, was then applied about the whole foot, and one grain of opium was directed to be given every hour. Previous to Dr. Gay's arrival, I had given him five grains, in two doses, half an hour apart.

6, P.M.—Still suffering from severe pain. Its character, however, has changed. He now complains only of the pain in the seat of injury—none at all in the leg or thigh. Objects to pills, therefore substitute sol. morphia (sulphate), one eighth of a grain every hour.

Nov. 2d, 7½, A.M.—Reports that, soon after taking the morphia, began to sweat, and has continued to sweat profusely since. Slept more than half the night. There is one spot about as large as the head of a nail on the upper side of the toe, over the original puncture, as if the nail had gone through the joint as far as the skin on the upper side. Has had a dejection, and passed urine freely. Continue treatment.

P.M.—Has passed a comfortable day, and now feels quite easy, except a constant fear of "lock-jaw." To have a double dose of morphia previous to going to sleep, and continue poultice.

3d.—Reports better. Slept all night. Took but one dose of morphia. Soreness gone from upper side of toe. Incision remains open. No discharge from it. No pain there. Can move toe-joint more freely, but with some pain. No perceptible swelling.

4th.—Foot perfectly easy. Tongue clean. Appetite good. Feels well. Left him, with directions to abstain from use of his foot. Apply the poultice through the next day, then wrap the joint in a cloth wet with tr. arnica.

From this time he went on improving till the 7th, when, as he was sitting at the table, he was seized with a pain in his back, and difficulty of swallowing, accompanied with an uneasy sensation in the upper part of his throat.

Nov. 7th, 3, P.M.—Is very much excited with the fear of lock-jaw; pulse 100, full; skin moist; lips and mouth dry. Cannot open the jaws quite an inch. Speech affected. R. Ext. cannabis Ind., ʒ ss. Ft. pil. x. To have one every three hours. Inhale ether, pro re nata.

Feeling that in the progress of the disease—and the symptoms left no doubt of its nature—he would soon be unable to swallow in sufficient quantity to admit of administering as much sedatives as might be thought judicious, I determined to try the effect of subcutaneous injections. Dr. Ruppaner, well known to the profession in this city for his very successful employment of this means of cure in neuralgia, kindly offered his assistance to give them a fair and thorough trial.

6½, P.M.—Pulse 105. Mouth and tongue as at last visit (dry and slightly coated); sweating freely, with warm perspiration. Had a slight spasm at 5, P.M. Feels less stiffness about the jaws, and can open them a little wider. Cannot swallow, except with the greatest difficulty. Could not swallow the pills, and the solution of morphia has been given instead. Speech rather more natural. Has not the slightest pain or tenderness at the seat of original puncture, and can move the joint with perfect ease and freedom. Injected half a drachm of the solution of acetate of morphia, of the strength of one grain to a drachm of sherry wine.

This was thrown into the inside of the right leg, about midway between the knee- and ankle-joint, just at the inside of the saphenous nerve. Immediately after this injection, the pulse fell to 89 and 90 in the two succeeding minutes, and it was more soft and compressible. No nausea followed. The only sensation noticed was a little prickling at the spot where the injection was thrown in. To omit the pills, but continue the solution of morphia and the inhalation of ether, p. r. n.

Nov. 8th, 8, A.M.—Pulse 84. After injection last night, slept for an hour. Jaws relaxed, and could be moved freely. At about midnight, the pain and spasmodic action of the muscles of the spinal column began to return. Ether was given, but causing nausea and attempts to vomit, it was stopped and not resumed. The solution of morphia was swallowed with the greatest difficulty, and less, probably, was administered, on this account, than ought to have been under the condition he was in. Is now (8, A.M.) lying on his back, with the head thrown back and strongly fixed in that position. Cannot lie in any other position. Jaws less than half an inch apart. Injected right arm with half a drachm of the solution used last night. Pulse 90 during the first minute afterwards; 84 during the second; and 80, the third. This injection not having any effect on the pain in the spinal column, a second injection, of equal strength, was thrown in, in the left lumbar region, at the angle formed by the spine and the crest of the ileum, at the place of the greatest tenderness. No nausea succeeded, although the quantity of morphia thus injected was a whole grain. Pulse after second injection, 90. It then gradually subsided to 78, 82; slow when perfectly quiet—about 70; but when spasms came on, it rose to about the rate of 100 for a part of a minute. The above rate —78, 82—was for two consecutive minutes. A teaspoonful of water put in his mouth is swallowed only after long and painful exertion. Had two profuse discharges of urine through the night. No dejection.

1, P.M.—Has had no pain at all in his back since the injection this A.M. Jaws in same condition as reported this morning. Spine has recovered its flexibility. All he complains of now, is, a sense of constriction about the throat, as if he should choke. Injected, opposite the seventh cervical vertebra, half a drachm of a solution of morphia, four grains to the drachm of sherry wine. Pulse, before injection, 80; afterwards, 104. No nausea.

6, P.M.—Pulse 88, rather irregular. Skin moist. Reports more frequent spasms since last visit. At times, springs up from the bed. Pain has returned, to a limited degree, in the back. The side of the neck, where the injection was thrown in at 1, P.M., more free. Muscles on the other side tense and hard. Mind clear. Injected fifteen drops of solution of atropia—one grain to twenty-four drachms—on left side of neck, opposite seventh vertebra. The immediate effect of this was an increase in the spasms. Feels the prickling of this injection much more than that of the morphine. Feels it all over. Pulse, after injection, 94. Five minutes afterwards, the pulse rose to 140. Says he feels no pain at all.

11½, P.M.—Reports that he slept an hour after the injection at 6, P.M., without waking. After a short interval, slept again for about the same length of time. Since then, has been growing worse, with more frequent spasms. Pulse 140, most of the time (according to his attendant). The opisthotonos is now strongly marked. Head turned over left shoulder. Cervical muscles very tense, and clavicles drawn up so as to cause deep hollows on each side of the neck. The slightest touch, or breath of air, or jar, brings on an attack of convulsions. Cannot swallow at all. Teeth separated only about one fourth of an inch. Respiration free, and normal in frequency. Has been wandering most of the time since last visit. Complains of great agony (or, as he terms it, cramp) during the spasms. Injected solution of morphia—three grains to a drachm—in four places, half a drachm each, viz., in the spot of most pain at the lower part of spine, on left side, where an injection was thrown in yesterday; on inside of right thigh, just above the knee; on the right shoulder, just in front of the acromion process of the scapula; and on the left side of the neck above the clavicle. At the time of the injection the pulse was 140. It immediately fell to 104, where it remained. The spasms diminished, and he dozed off to sleep before the visit was finished. Patient has been much incommoded through the whole case with collection of saliva or mucus in his throat, requiring the constant use of a handkerchief to wipe away. He was ordered to be etherized as soon as the return of the spasms showed the effect of the injection to be wearing off, and its use pushed to the extent of producing muscular relaxation if possible. No dejection, and no urine.

Nov. 9th, 6½, A.M.—Has slept most of the time since last record, till within half an hour. No severe spasms or pain. Ether has been given only during the last half hour. Is now strongly convulsed. Head cannot be moved, and back very stiff. Says he has no pain, but is choking to death. Voice almost a whisper. While an injection was being made ready, a most violent attack of convulsions came on, and although it was thrown in as speedily as could be done, just below the clavicle on the right side, of the same strength that had been used the night before, it had no effect to mitigate the force of the spasm. The whole frame became rigid, the eyes fixed and staring, the body and head bent far back, and every tendon and muscle hardened into cords, under the skin. There was was an apparent inability to breathe, from constriction of the respiratory muscles about the lungs, and the heart came to a dead stop for several seconds, as if involved in the general condition. This state of things continued for a while, but abating somewhat, the pulse returned, very feebly and intermittent; the respiration went on as if in a firmly bound tube, the ribs remaining fixed during the time, and he shortly breathed his last.

The relative fatality of tetanus, when arising from a traumatic source, is rather more than 50 per cent. Of 128 cases collected by Mr. Curling, 58 terminated successfully, and 70 died. Of the latter, 53 were fatal within eight days of the appearance of the symptoms; 11 on the following day; 15 on the second day; 8 on the third; 7 on the fourth; 3 on the fifth; 4 on the sixth; 3 on the seventh; and 2 on the eighth day after the injury, but very few after a longer period. One case is reported where death followed a scratch in a quarter of an hour; others where the fatal result took place in twelve hours, sixteen hours, twenty hours, and twenty-two hours from the appearance of the tetanic symptoms.—(*Copland's Med. Dict.*, Art. Tetanus.)

The length of the period of incubation seems to bear some proportion to the severity and fatality of the attack. The longer the interval between the injury and the appearance of the symptoms, the less acute and dangerous is the disease (*loc. cit.*), and, *vice versa*, the more rapidly the disease follows its exciting cause, the more severe and fatal does it prove.

The treatment may be divided into surgical and medical. Both have been carried out to their utmost extent, and the final summing up of the whole matter is, that all modes of treatment have succeeded in certain instances, and on the other hand all have failed to cure. In view of this fact, then, it cannot be said that, by any particular course, we offer the patient a greater chance of recovery than what has resulted from any other.

But while local treatment is admitted by all writers to be useful, and most judicious in all cases at first, the main reliance, after the case resolves itself into one of actual tetanus, must be upon constitutional treatment. Of this, the books and periodical literature teem with varieties. All sorts of applications intended to affect the nervous system, through the agency of the spinal cord; bloodletting; baths of all kinds; purgatives; alteratives; stimulants; antimonials; sedatives; narcotics; have all, by turns and together, been brought to bear upon the disease, and over all is written "failure."

Nevertheless, amidst all this want of success, there is one settled point—That where the cases have recovered, the result seems to be due, in traumatic tetanus especially, to the sedative effect of the remedies exhibited. Thus, tobacco, hydrocyanic acid, the resinous extract of Indian hemp, opium, both pure and in the form of its salts, stramonium and belladonna, when combined with such other treatment as best fits the system to receive the full effect of their action, have given the greatest satisfaction, and promoted the cure in the greatest number of cases.

In Mr. Curling's work, as quoted by Dr. Copland, are also found instances of injecting into the veins the watery solution of the extract of opium and stramonium, and also a solution of acetate of morphia, but with no marked benefit over other treatment.

The case detailed above is probably not different in its symptoms and course from those which have been from time to time put on record by various reporters. It is interesting mainly from the kind of treatment which was adopted, and which, if it did not bring about the wished-for result, was, at least, the means of mitigating, to a great degree, the sufferings which, under ordinary conditions, are the inseparable accompaniment of this affection.

Experience has demonstrated, that diseases of the nervous system which manifest themselves by pain along the course of the nerves, such as the various forms of neuralgia, are more speedily relieved and eradicated by subcutaneous injections than by any other means. (For example of this, see Dr. Ruppaner's Report, BOSTON MEDICAL AND SURGICAL JOURNAL, April, 1860, *et seq.*) In many instances, the cure is immediate; while in others, more than one trial is necessary before the desired result is attained. This success shows what a powerful effect can be produced in this way, and how much more efficient, remedies become, when subcutaneously administered, so as to act directly on the affected part, than when they are exhibited in the ordinary way. In view of this fact, and with the knowledge that it was vain to expect from any known and applied method of treatment, any certain results, it was determined to apply them faithfully and persistently, in this case. The immediate effect was to allay the spasms, ease the pain and cause sleep; three benefits, which, alone, would give this mode of administering remedies a high place among others. But it also promised other advantages. Being applied locally, subcutaneous injections can be employed throughout the whole of the progress of the affection, and to any desired extent. This makes us independent of the state of the throat, which, in the case reported, very soon after the tetanic symptoms made their appearance, rendered it impossible to swallow anything but the thinnest liquid, and only the smallest quantity of that even. Indeed, it is not stating too strongly to say that any amount of sedative in solution, sufficient to have exerted any effect upon the system under such a degree of nervous excitement, could not have been administered in any other way. We have, then, in subcutaneous injections, a mode of administering remedies which promises to accomplish all that can be attained by the exhibition of remedies by the mouth, even by aid of the stomach tube, unaccompanied by any derangement of the stomach so far as unfitting it for nourishment, where that can be taken; entirely independent of that condition of the throat which, in many cases, renders swallowing impossible; which can be pushed to any extent, no matter what may be the general condition of the patient; and which does not at all interfere with, or prevent, any other treatment that may be thought desirable at the same time.

The effect of the injections was prompt and powerful. Its action was first signalized by the acceleration of the pulse, which came on immediately after the injection had been thrown in. A prickling sensation also was noticed, which gradually extended throughout the body and extremities. These symptoms were succeeded by a diminution of pain and relaxation, to a certain extent, of the contracted muscles. And even when the spasmodic action was decided and strong, there was none of that suffering or expression of agony which is sometimes witnessed, until after the effect of the injection had begun to pass off. The contrast between the condition in which the patient was, when under the influence of the injections, and that which was the result of etherization, carried as far as could be, was marked, and greatly in favor of the former.

There was a noticeable difference in the effect of the injections, both upon the circulation and the muscular tension. The action of the acetate of morphia appeared to be purely and directly sedative, reducing the pulse, diminishing the pain, relaxing the muscles and causing sleep; the atropia, on the other hand, acted both as a sedative and a stimulant. While it more speedily and effectually put an end to the pain, and, like the morphia, induced sleep, it appeared to cause an increase of the spasms at first, accelerated the pulse, and brought on slight mental aberration. Reasoning from analogy, it would have been worth while to have given nicotine a trial, for in a case reported (*Braithwaite's Retrospect*, No. 38, p. 46, American Edition, from *Medical Times and Gazette*, July 31, 1858), it proved to be the means of cure; and the alleged power of tobacco in overcoming the effect of strychnine, adds to the probability that it will be found a very efficient remedy, as the similarity between the convulsive action caused by strychnine and the spasms of tetanus affords a ground for belief that what will counteract the one, will also operate favorably on the other.

Another fact brought out in the course of the treatment is worthy of notice. It is this:—A portion of the nervous system can be brought under the effect of a sedative while the rest is unaffected. *E. g.*, on the 8th (the second day after the appearance of the tetanic symptoms), the injection caused a relaxation of the muscles on that side of the neck, while the condition of the other side remained the same as before. So, also, the injection thrown into the arm, at the same visit, produced no effect upon the pain in the back, which was, however, immediately relieved by an injection in the place where the pain appeared to commence. May we not, then, in a properly graduated subcutaneous injection, possess a more powerful and serviceable local anæsthetic, than has as yet been employed. When we take into consideration the comparatively feeble effect of endermic applications, when compared to this way of reaching the nervous branches, and the danger which must always attend the freezing process when applied for the purpose of deadening the sensibility of living tissue, it is worthy of trial.

The result of the case reported above was fatal, and in so far as a successful result is necessary, to give to a remedy, or mode of treatment, prestige, and a claim for adoption generally, it cannot be adduced in favor of subcutaneous injections, as a means of cure in tetanus. But the same objection applies to all other kinds of treatment, and therefore the method adopted in this case is no less worthy of confidence and repeated trial than any other, and its good efficacy in abating the agony of the spasms, allaying the irritability and sensitiveness of the patient, and generally of alleviating the sufferings of this most awful affection, certainly demand for it a fair and thorough trial.*

THE VALUE AND THE FALLACY OF STATISTICS IN THE OBSERVATION OF DISEASE.

A BOYLSTON PRIZE ESSAY, BY DAVID W. CHEEVER, M.D.

[Continued from page 456.]

It is impossible that we should arrive at a certain medical comprehension and science by mere observation, and the collection of so-called experiences and facts, of themselves; for this is only the first step. The savage, wandering in the forest, sleeping without shelter, and dependent on the wind or weather for power of locomotion and the means to reach his prey, has no doubt always been a keen and constant observer of the heavenly bodies and the clouds during all the nights of his existence. But his experience, unaided by comparison and generalization, has never taught him the true magnitude, or motion, or relations of the stars, nor the simplest laws of meteorology, as laws, and not as successive and empirical facts. Nor would the physician ever obtain, by mere observation, whether by palpation, auscultation and percussion, or by autopsies and microscopical and chemical examinations, however minute, a true insight into the real condition of his patients.

These are all means of knowledge, but, unless aggregated and compared, they must remain only isolated, empirical facts. We cannot wholly separate theory from observation, even by substituting figures for words. We must be careful only that our theories are based on constant and recurring facts. Even the purest empirical writer on Medical science, styles that science, "*the phenomena of life, with their relationships, classified and arranged.*" And although anxious to have it understood that science is not the inductive or reasoning process added to facts, nor a theory built upon facts, yet he equally includes the classification and arrangement of phenomena, under his definition.

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* Since the above was written, my attention has been called, by Dr. Ruppaner, to a report of a case successfully treated by subcutaneous injections. For details, see *British and Foreign Medico-Chirurgical Review* for October, 1860. Cap. Therapeutical Record, p. 559:—"On a case of Traumatic Tetanus treated with success by injection of Sulphate of Atropia."

Such classification, dependent on the identity or similarity of certain groups of phenomena, and their dissimilarity to others, necessarily requires comparison and generalization. And although some exercise of invention or intuition may lead to useful discoveries, afterwards confirmed by experience, yet *à priori* conclusions are but too apt to be premature. Induction; reasoning *à posteriori*, which forms the distinctive feature of the Baconian philosophy, is the safer course in all sciences. Theorists have uniformly neglected it; but careful observers have attained their most important results by following its laws. By it, or by observation and *experiment*, that *vexatio naturæ*, as Bacon calls it, the physical sciences have alone advanced. So all other branches of knowledge, which are, from their nature, incapable of demonstration, must proceed by comparing observations, and analyzing experience, rather than by either *à priori* theories, or simple empiricism, to establish general principles, and natural laws. But what is called a law in natural science, differs somewhat from the popular use of this expression. A law of Nature is nothing else than a general expression of the conditions under which certain phenomena occur, so far as these conditions are known to us.

We cannot account for a phenomenon by referring it to a general law. The law, or generalization, is governed by the phenomena, and not the phenomena by the law. So, for the sake of illustration, the laws of grammar are the expression of the conditions under which certain words and expressions usually occur. And when we say that an expression is at variance with the laws of grammar, we mean only that it differs from the more general usage which constitutes those laws. Good usage does not depend upon grammar, but grammar upon good (general) usage. A law of nature, also, has no cöercive power whatever: whenever we speak of phenomena as *governed* by law, we imply some higher *will*.

The common fallacy that "the exception proves the rule," while it may show our generalization to have been imperfect, really means only that the exception indicates by its rarity the existence of some more general mode of action, to which the majority of phenomena can be referred.

They, therefore, who seek to establish positive laws of disease by the accumulation of isolated facts of experience, succeed, it is true, in proportion to the breadth of their researches, but cannot, as long as their observations are finite, arrive at absolute laws. Particularly in the complex and vague field of medical experience, it is still more difficult to establish and verify general principles, or laws.

Another source of fallacy lies in the common acceptation of the word *cause*. Usually held to mean the power which originates any action, it logically includes also the conditions of its operation. Thus, heat, generating steam, is the power which moves the locomotive; and its machinery, the condition of its progress. Both would be called the cause of motion; though, properly speaking, one is a dynamical, the other a material cause. So, in the human body, vital force may be the power, and respiration the condition of life; or miasmata might be the cause, and intermittent fever the condition of disease. Too much care cannot be taken, in investigating that most important branch of science, the causal connection of empirical facts, to bear in mind this difference in the signification of the term *cause.*

It is obvious that the causal connection of isolated events in medicine is not to be reached by any single, simple process of experience or numbers. For the course of reasoning by the inductive process is, first, observation; second, comparison and generalization; and, third, the establishment of causal connection: and when we know *all* the conditions and modifying processes, we can establish a natural law. Therefore the observer needs, a mind to guide observation; observation to acquire facts; logic to estimate the value of observation; analysis to separate complex facts; analogy to compare them; statistics to average individual facts; the calculation of probabilities to define, as acurately as possible, the value of his results; and many aggregates, and almost infinite observations, to generalize laws.

Why medicine should fail in meeting our requirements, we can best consider by comparing it with the more exact sciences.*

The most perfect kind of human knowledge is that embraced by the pure mathematics. What are called the primary existences, as space, time and number, we cannot conceive *not* to be. Not only are they necessary existences, but all men who think about them must get very nearly the same notions concerning them. The measure of space, time, quantity and magnitude is number: number has the same meaning for all mankind, and it is the only thing about which difference of opinion is impossible. Numbers being independent of the things counted, and free from the errors of language, we can reason upon them, as we can upon nothing else. Arithmetic, Algebra and Geometry, and the whole of the pure mathematics, being sciences of quantity, and hence of numbers, and being freed by their symbolic expression from the errors of language and the errors of sense, are, as far as they go, perfect sciences. Arithmetic and algebra prepare, by their numbers, instruments of calculation for the use of the other sciences. The simplest use of these instruments of calculation is in the science of astronomy; which is eminently a science of numerical relations, as well as of pure observation. Calculation is the secret of the success of this science, and also of statics, dynamics and optics. These are all sciences treating of those simple relations and properties of matter which admit of being represented by lines, figures or symbols. The observations on which these sciences are based are of the simplest kind; and they offer the example of sciences of observation not much inferior to the pure mathematics in accuracy. Yet fallacies exist even in these sciences. In astronomical observations the senses are fallible, and the nicest instruments admit of error. But the astronomer rectifies his errors by multiplying his observations: he has recourse to the numerical method, and takes the *mean* of as many observations as he can procure.

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* *Vide* "British and Foreign Medical Review."

Chemistry is a science which makes extensive use of calculation, but is still more dependent on the exercise of the senses, since the properties of matter which it investigates are more complex and obscure than those of the heavenly bodies. The chemist, however, has the powerful aid of experiment; for he can create and re-create almost at will. He can make the objects of his investigation identical; he need determine them but once; he can use them also to determine others. But figures pervade the whole science, and all its statements are made in the numerical form.

A numerical theory—the law of definite proportions—converted the art of chemistry into a science: a position which it might not have reached by the mere questioning of nature—by experiment alone. The chemist, like the astronomer, has to multiply his observations and experiments to avoid error. Calculation, and his power of making the matter he employs identical with that which he has already ascertained, give perfection to his science. He is capable of synthesis, as well as analysis. But when he reaches the *organic* world, synthesis fails. And here we have the first sign of the uncertainty, the first shadow of the difficulty, which awaits the observer at the threshold of *Life.*

The mechanical properties of matter are investigated with as much zeal as its atomic affinities. A knowledge of them can be obtained only by repeated experiment, because they resemble each other, but are not identical. The mechanic, therefore, has recourse also to the numerical method: to ascertain the strength, or the durability of wood, iron or stone, he must take the mean of many trials.

Astronomy and chemistry, the one a science of observation, the other of experiment, owe their perfection mainly to calculation. The former is the more perfect, since it deals with simpler relations of matter, and depends less upon the exercise of the senses, than the latter. But the latter owes its superiority over mechanics to the power which it possesses of making the objects and results of its experiments identical with those which it has already ascertained, and which bear the same name.

The certainty of a science seems, therefore, mainly to depend upon the extent to which it admits of the application of numbers and calculation, or of the numerical method, to rectify its errors.

It is not surprising, then, that much should have been hoped from its employment in the notoriously uncertain science of medicine, but only that it should not have been earlier applied.

The imperfections of medicine as a science are inherent in the subject itself.

> "The physician, unlike the mathematician, is not the creator of his own science; unlike the astronomer, he has no simple relations of matter to deal with; he cannot, like the chemist, make any two things which he examines or uses identical; the objects of his study are more variable than the winds and tides; and the materials with which he works infinitely more difficult to adapt to their uses than the matter which the mechanic or engineer presses into his service. In all his preliminary studies (with the exception of inorganic chemistry), in all his original inquiries, in all his practical applications, he encounters the varying effects and complicated phenomena of Life."

True observation, or the union of reason and perception, the diligent use of the senses, not ignorantly or empirically, but knowingly and with a plan, can alone afford us any hope of penetrating to the arcana of the living functions in health and disease.

Medicine is a science rather of observation than experiment: for the latter method is impossible in the natural history of disease, and of very limited and doubtful application in the therapeutical art. We cannot isolate individual influences from the magic circle of the functions of the body; nor thus place them in a distinct and favorable light for single, or repeated experiments. Were this possible, we should still be under the influence of one-sided and special views, and be in danger of seeking for that only which we wished. It is doubtful, moreover, whether we should be much the wiser, even if we could produce artificial diseases, or experiment with drugs: for the causes would be so complicated and numerous, that we could not judge of the effect of each.

As observation is, then, from necessity, our chief method of acquiring medical knowledge, we might expect numbers, which express only aggregated, classified or generalized observations, to be of much aid to us in our pursuit.

After these necessary preliminaries, which have taken up so much space, have been duly considered, we have found by their statements, that the senses alone, and numbers by themselves, can do nothing; that the natural history of disease, though the most important part of medical knowledge, is the hardest to obtain, while the want of it has given rise to conflicting theories; and that the student of medicine is oppressed by the multitude of isolated facts. We have glanced at the origin and history of the numerical method, and at its wide employment now in various sciences; and have shown that experience alone will not serve us, but that we must look for the causal connection of events: and while they are to be sought by analysis and synthesis, yet since generalization is peculiarly difficult in medicine, we finally must agree with the logician, that no effect or event can be predicted with certainty in our science or art. We have shown why the science of medicine is superior to the art; that the numerical method is even more inaccurate in the latter than in the former: also, that medicine, not being entirely empirical, we must classify and arrange our observations. We have endeavored to explain why induction is the only true way to arrive at laws; and to prove, by the true definition of the term law, why finite observation cannot establish absolute ones. And having shown that various mental processes, as, logic, analogy, comparison, &c., were needed in true observation, we have lastly compared medicine with the exact sciences: and inferred, from its great advantage in them, that the numerical method should be tried in the science of medicine.

We are now ready, therefore, to judge of the value and the fallacy of statistics in the observation of disease. It will be more convenient to reserve their value for our final consideration, and we will first treat of the *Fallacies* of the numerical method, as applied to the observation of disease.

Such fallacies may, in the nature of things, exist either in the object, or the observer; may depend on some inherent defect in the thing observed, or upon defective observation on the part of the person observing. And first, with regard to the fallacies in the object.

The value of our observations depends on both their quality and their number. The most positive results in any science are attained just in proportion as the facts compared, which form the basis of the statistics, are identical. Identity of facts, submitted to the numerical method, cannot be found in medicine. No series of phenomena constituting disease, whether occurring in different patients, or in the same patient at different times, can be identical. Even the most exact of symptoms, those included under the head of Physical Signs, cannot be expressed by symbols, or figures; nor are their relations so simple, nor their analysis so exhaustive and complete, as to warrant their being always considered *the same.* Although the numerical method is not a mere substitute of figures for words, yet its results will always be accurate in proportion to its approximation to figures, which are ever one and the same. No diagnosis can be so minute, no malady so defined, no human body such a machine, as to give identical results. Therefore, not only the demonstration of pure mathematics, but the identical certainty of experimental chemistry, must be foregone in medical science. But if no identical units of observation can be obtained, our next care must be to obtain those which are strictly *comparable;* for without this condition is fulfilled, our conclusions will be not only inexact, but of no value whatever. There is, first of all, great room for error in the selection of our cases, and in the circumstances under our control. The disease must be well defined and carefully diagnosed; and in this respect, acute are much preferable to chronic maladies, for the latter are, at best, of very difficult classification. It is obvious that cases of a different nature may be confounded together, and improperly compared in statistics. The symptoms are of little value without a just notion of the cause of the disease, and the real nosological whole which the entire group of symptoms represents. Thus, a bellows murmur in the heart may depend on a peculiar constitutional disease, as rheumatism; on ossification of the valves, from age; on disease of the lungs, reacting on the circulating organ, or on some peculiar state of the blood itself. Therefore it would not do to compare, for the purpose of tabulating and averaging, every case which presented a valvular murmur in the cardiac region, without a knowledge of other concomitant disease, or the nature of the cause.

The patients must also be placed under the same circumstances of attention, diet and treatment, if the observations are to be continued through the natural history of the disease. But there are many circumstances beyond the control of the physician.

It is not, however, absolutely necessary that those things beyond our control should be included in the laws of comparable cases, nor that the want of them should invalidate our conclusions. It is true that we shall not get strictly comparable facts without them. But since the variability is known and limited, we can remedy it, in a measure, by the application of the numerical method.

But this requires the application of very large numbers of observations. This is well exemplified by the state of Life Insurance Companies in America. Known causes of disease and laws of vitality are carefully collected and compared, but a vast number of unknown ones yet remain beyond control. To remedy these errors, the number of facts must be enormous, and extend over a long period of time. A sufficient number of years have not yet elapsed, since our country became populous, to furnish facts enough. And the result is, that the mortuary statistics of American Life Insurance Companies are far inferior in reliability and exactness to those of the older countries; and hence, as a secondary consequence, the profits and success of such companies are far more precarious here than there.

So much is this the case in medical statistics, that the more modern advocates of the numerical method charge even Louis with having based his conclusions on too few facts. The application of very large numbers to the calculation of probabilities, we shall consider further on.

The larger the number of cases, the nearer we approach to demonstration. And to secure the greatest comparability, with the fewest sources of external error, and the best chance to correct them by multiplication, we must employ "the simplest cases of a similar kind in the smallest possible field; and the same kind of effects under the greatest variety of circumstances: and, finally, collect and compare the results."

Besides even the impossibility of procuring identical facts, or the chance of strictly comparable cases, we shall find another source of error, even in those cases which are comparable, in the individuality of each case. Patients are not bundles of symptoms, nor are diseases always bounded by the same formal laws. And it has been well said that we cannot weigh a cough, measure the exact extent of a pain, nor determine fever by the atomic theory. Idiosyncrasy, or the peculiarities of the individual, are as anomalous and impossible to reduce to rule and measure, as the passage of the clouds. Nor are they infrequent. While similarity is frequent, there is usually enough unlikeness for comparison. Two cases of disease are as rarely identical in all their features, as are the faces of the patients. No depth of observation, no accuracy of numbers, no vastness of tables, and no grasp of memory, will ever enable the practical physician to reduce the case before him to real rule and measure, or to dispense with the necessity of considering each patient by and for himself.

[To be continued.]

Reports of Medical Societies.

EXTRACTS FROM THE RECORDS OF THE BOSTON SOCIETY FOR MEDICAL IMPROVEMENT. BY FRANCIS MINOT, M.D., SECRETARY.

Nov. 26th.—*Pneumothorax.* Dr. Jackson reported the final result of a case that was under his care not long ago in the Hospital, and of which he has already given a partial account (see Journal, Oct. 11th). The patient had recently died under the care of Dr. Samuel Alden, of Bridgewater, from whom Dr. J. had received the history of the case, with the organs removed after death. The patient gradually sank, from the time that he left the Hospital until his death, which occurred on the 17th instant. Eight weeks previously he was tapped, aad two quarts of purulent fluid were drawn from the left pleural cavity, and two weeks afterwards a smaller quantity was drawn off at a second operation. On dissection, air issued with considerable force when the left pleural cavity was punctured; and, on laying it open, it was found to contain eight quarts of pus. The pleural surface was covered to a considerable extent with soft, opaque, sodden-looking lymph; being elsewhere reddened, quite free from the deposit, and looking not unlike a mucous surface. The left lung was much compressed, and lay along the mediastinum; being quite free, except for the old adhesions about the apex, where the surface of the organ was torn or cut in removing it from the body. In the upper lobe of this lung numerous old tubercular cavities were found, filled with a whitish, pasty substance; the lower lobe being much less diseased. No opening was found in the surface of the lung by Dr. A.; and very little attempt to find one was made by Dr. J., as the lung was torn as above stated. The right lung was generally healthy; but a considerable amount of tubercular deposit was found in the lower half of the upper lobe, and some in other parts of the organ. The heart lay entirely in the right side of the chest; and, as well as the pericardium, was quite healthy.

Nov. 26th.—*Cancer of the Foot in a Child.* Dr. MORLAND stated that on Wednesday, the 21st inst., he had removed the diseased foot from the boy whose case he reported to the Society, October 8th. The amputation was performed about three inches below the knee, by the usual anterior and posterior flap-operation. Drs. Coale, Minot, Brown and Sawyer, and Mr. Weymouth, a medical student, were present, and rendered valuable assistance. Very little blood was lost; seven ligatures and three sutures were applied, together with simple water-dressing, before the child recovered from the effects of the ether given.

The stump was not disturbed for four days. Almost no pain has thus far been experienced by the patient. An opiate was administered as a precautionary measure, in the evening of the day of the operation; and stimuli were used, freely, for three days, but have since been only occasionally given.

Dr. Coale very kindly made an excellent cast of the foot, immediately after the operation, and presented it to the Society.

Dr. Ellis examined the foot with great care, and verified the diagnosis previously given. His account of the specimen is appended:—

"The growth lay mostly between the plantar fascia and the bones of the tarsus and metatarsus, and extended from the os calcis to the phalanges. From the large central mass, lobules projected in all directions. The astragalus was intact, but the os calcis had been partially destroyed, and much of the remaining portion was more or less involved in the disease. Some of the small tarsal bones had escaped, but others were entirely concealed, if not destroyed. The growth was of a dull-white color, generally, with here and there yellow streaks or points, which marked the degeneration of the tissue. It contained much milky fluid, and, though mostly of considerable consistence, was, in parts, quite soft. Examined with the microscope, it was found to be composed of fibrous tissue and nuclei, the latter being generally smaller than those usually found in malignant growths, and granular; but there were also seen large nuclei, with large nucleoli."

Dr. Morland added, that on examining the stump, on the fourth day after the operation, it was found to be in an excellent condition; there was no bagging of matter, and everything indicates a good chance for union, throughout, by the first intention. The pulse, which was 120 for two days after the operation, fell to 100, and below, on the third and fourth days, and continues to be of good character and force. The syrup of the iodide of iron has lately been given to the patient, and a nourishing diet maintained.

January 7th.—The patient is doing well in every respect. Stump healed, except around one remaining ligature, which still holds firmly.

DEC. 31st.—*Diphtheria?* Dr. AINSWORTH reported the following case.

A man, 62 years old, about four weeks before death, was seized with fainting at his place of business, and was taken home. He complained of pain in the throat, difficulty in swallowing, and was hoarse. He had chills, which continued at intervals for twenty-four hours. The next day the sore throat was better. The submaxillary glands were swollen; there was cough, with expectoration. The third day, he returned to business, telling his family that his throat was almost well. However, at night, there was considerable cough, with profuse expectoration. The appetite and strength failed gradually for two weeks. He was then taken, while at his business, with pleuritic symptoms with severe rigors, and was obliged to return home. He was unable to lie on either side. These symptoms abated after the use of counter irritants, but he found great difficulty in swallowing; liquids, in every form, regurgitated through the nose, producing cough and strangulation. At first, solid food, in small quantities, could be swallowed, but in a few days these also were rejected. There was very little pain; the breath was not fœtid; the expectoration was excessive; the cough not severe. Death took place, apparently from exhaustion, a week after the last attack.

At the *autopsy*, some flakes of recent lymph were found about the lower posterior surface of the right lung; about a third of the upper lobe was in a state of red hepatization. The left lung was healthy. The mucous membrane, about the roots of the tongue, epiglottis and tonsils, was covered with a thick, greyish, pultaceous coat, having an odor like yeast, or a sour-meal poultice. At this place, the membrane could be easily scraped off—seeming to have no tenacity. The mucous coat lying beneath had a red, granular aspect. Following down the œsophagus, the false membrane became thinner, but more firmly organized, giving, when torn up, a flap about one quarter of an inch in length. The mucous membrane was much injected, being thickly streaked with small blood-vessels. The false membrane extended to the stomach. Below the larynx, the trachea was more inflamed than the œsophagus, the false membrane more easily broken, and often mixed with mucous sputa. The inflammation extended to the substance of the lungs, assuming in the bronchi the appearance of severe bronchitis, the membrane being probably detached by coughing.

THE BOSTON MEDICAL AND SURGICAL JOURNAL.

BOSTON: THURSDAY, JANUARY 10, 1861.

Diphtheria.—We publish the following letter upon a subject of much importance. Fears of the prevalence of some dreaded epidemic are often excited by those who have either mistaken the character of the disease, or who wish to gain credit for remarkable cures.

We have heard of but few cases which resemble diphtheria, and these will be reported in the transactions of the Medical Improvement Society.

Messrs. Editors,—I am asked very frequently by patients about diphtheria, which the public have an idea is very prevalent and very fatal. I have been happy to inform them, that I have not as yet seen a single case, which in the slightest degree resembles the descriptions, given by writers on the other side of the water, of that disease; nor have I heard, from those of our profession, of whom I have inquired, that they have been any more unfortunate than myself. By a member of the profession, who makes certainly as many *post-mortem* examinations as any of us, I have been informed that he has yet to see the first case.

The weekly record of deaths certainly does not show that the disease is epidemic in this city, although one death is reported from it last week. As every patient who has a sore throat is alarmed by the horrible anticipation of what some gentlemen describe, would it not be well for the MEDICAL JOURNAL to state the facts in the case? If diphtheria be as abundant as has been represented, some of us might then be put on our guard. If it be not so, perhaps the daily newspapers, which occasionally give as interesting items, accounts of numerous deaths from diphtheria out of Boston, would also say a word to allay the fears of their readers. C. E. B.

REMOVAL OF DR. MORIARTY.—The removal of one of the most faithful and long-tried of our city officials, the Superintendent of the House of Industry at Deer Island, has naturally created much surprise and regret. As we have no means of knowing the pretext for this unceremonious act, we can only conjecture that somebody wants a portion of the spoils, and therefore two are to be allowed to bite the cherry instead of one. The fact, that Dr. Moriarty is to be retained as physician of the Institution, does not relieve the City Government from the imputation of having done a gross injustice by placing an old and most efficient officer in a false position before the public. After twelve years' service, alike honorable to himself and to the city, without notice or warning, he suddenly receives information that he had been superseded, leaving an impression on the public mind which a full and frank explanation only can efface. It is due to Dr. Moriarty, says a contemporary, "that such impression should be corrected, for it is well known that the House of Industry under his charge has become a credit to the city, and to-day will bear comparison with any institution in the country."

BERKSHIRE MEDICAL JOURNAL.—We have received the first number of this new monthly, which bids fair to fulfil the expectation of its numerous friends. It contains a long and elaborate article by the senior editor, Dr. Thayer, on Diphtheria, besides valuable miscellaneous matter. It is a well-printed pamphlet of 48 pages, most creditable to all concerned, and we wish our friends all possible success.

COLUMBIA COLLEGE.—Prof. Torrey has presented to the College his immense *herbarium*, the fruit of forty years' assiduous labor, together with his valuable botanical library. The herbarium is especially rich in North American plants, as it contains full sets of nearly all the collections made by the numerous exploring expeditions of the United States Government, from that of Maj. Long, in 1819, to the present time, and the original specimens from which the descriptions in the official reports were made. The herbarium is also authority for the plants described in the Flora of North America, by Dr. Torrey and Dr. Gray. The Floras of Europe, Asia, the Cape of Good Hope, Australia, and many other parts of the world, are largely represented by collections named by the highest authority. We are glad to be able to add that it is not the intention of Dr. Torrey to relinquish his botanical studies, for the Trustees have provided him with a residence in the College buildings, and ample accommodation for his herbarium and library, so that he will be able to prosecute this important branch of science under more favorable circumstances than he has hitherto enjoyed. It is his purpose to deliver lectures on botany at such hours as will not interfere with the regular studies of the under-graduates. He has also taken measures greatly to increase the herbarium and library.—*Am. Medical Times.*

OBSTRUCTION OF THE BOWELS FROM ADHESION TO THE UTERUS. By J. H. ALDRIDGE, M.D., of Southampton.—Mrs. S., aged fifty-seven, the mother of five children, had a severe attack of flooding in 1858. In February, 1859, symptoms of obstruction of the bowels came on, and became more and more aggravated until she died, on the tenth of April. Stercoraceous vomiting had existed for some weeks before the fatal issue, which seemed due to exhaustion.

Autopsy, two days after death.—The abdominal cavity alone was examined. The intestines were smeared with a yellowish, watery, offensive liquid, like that which had been vomited; but this may have escaped from the tube after death. The small intestines generally were greatly distended with gas; the ileum was highly inflamed throughout almost its entire length. Near its lower end were numerous dark-colored patches, of various sizes, where the whole thickness of the wall was gangrenous. For several feet above the ileo-cœcal junction, the gut was so softened as to tear when one coil was moved upon another. Here the contents were tenacious and putty like, but on the upper portion the same watery matters were found as had been vomited during life. The colon was nearly empty.

It was therefore evident that the obstruction was low down in the ileum, and on removing the intestines with the pelvic viscera, it was found that the gut alluded to was firmly attached to the posterior surface of the uterus in such a manner as to form a right angle. The womb itself was in a state of cancroid degeneration, being converted into a mass of epithelial cancer.—*London Lancet.*

COMPENSATION FOR WOUNDS.—The regulations under which pensions and allowances are granted to officers of the army have been revised by a Royal Warrant just issued. The loss of an eye or limb from injury received in action will be compensated for by a gratuity in money of one year's full pay of his then rank or staff appointment. He may be recommended for a pension, also, at a rate varying from £400 for a lieutenant-general, to £50 for a cornet; and if more than one eye or limb be lost, he may be recommended for a pension for each. For minor injuries, "not nearly equal to the loss of a limb," he may receive a gratuity varying from three to twelve months of his then pay. If the injury shall be so diminished as to be "not nearly equal to the loss of a limb," at the end of five years, during which the claimant must be twice examined by a medical board, the pension will then be permanent, otherwise it will cease. No pension or gratuity for these causes will be granted unless the actual loss shall have occurred within five years after the wound or injury was received. This scale of compensation is more liberal than by the previously existing custom, and will be received as a boon by those interested.—*Ibid.*

HOMŒOPATHY AT A DISCOUNT.—We see it stated that, at the opening of the session in one of the homœopathic colleges recently chartered, it was found that only *three!* students were in attendance, and neither of them was prepared to pay any *fees!* Whereupon, the Faculty dissolved, the dose being too *infinitesimal,* notwithstanding their master, the illustrious Hahnemann, declares that it is "impossible that the *dose* can be too small!"—*Am. Medical Gazette.*

HYPOCHLORITE OF ALUMINA.—Orioli recommends hypochlorite of alumina to be used as a bleaching and disinfecting agent, instead of the hypochlorite of lime and soda. It destroys more promptly, he says, organic coloring matter and gaseous matters of a mephitic nature.—*Chemical News,* London.

BY the printed catalogue just issued, the number of students attending lectures at the Mass. Medical College is 205. In the St. Louis Medical College the number is over 140.——Prof. Edward Warren, formerly editor of the *North Carolina Medical Journal,* is about to issue a journal from his new home, Baltimore, to be known as the *Baltimore Medical and Surgical Journal.*

VITAL STATISTICS OF BOSTON.

FOR THE WEEK ENDING SATURDAY, JANUARY 5th, 1861.

DEATHS.

	Males.	*Females*	*Total.*
Deaths during the week, ...	38	39	77
Average Mortality of the corresponding weeks of the ten years, 1850–1860,	39.3	37.7	77.0
Average corrected to increased population, ...	..	..	85.9
Deaths of persons above 90, ...	..	1	1

Mortality from Prevailing Diseases.

Phthisis.	Croup.	Scar. Fev.	Pneumonia.	Measles.	Smallpox.	Dysentery.	Typhoid Fever.
14	1	4	3	0	0	0	3

METEOROLOGY.

From Observations taken at the Observatory of Harvard College.

Mean height of Barometer, . . .	30.188	Highest point of Thermometer, . . .	40°
Highest point of Barometer, . .	30.600	Lowest point of Thermometer, . . .	10°25
Lowest point of Barometer, . . .	29.506	General direction of Wind,	W. N. W. & N.
Mean Temperature, ...	29°.75	Whole am't of Rain in the week . .	1.672
		Melted snow, ...	0.722

***From Observations taken by Dr. Ignatius Langer, at Davenport, Scott Co., Iowa. Latitude,* 41.31 *North. Longitude,* 13.41 *West. Height above the Sea,* 585.**

		BAROMETER.						THERMOMETER.				SNOW.		Mean Amount of Cloud. 0 to 10.
		7 A.M.	2 P.M.	9 P.M.	Mean Height,	Highest Point,	Lowest Point,	7 AM	2 PM	9 PM	Mean Height,	Time	Measure.	
Monday,	Dec. 24,	29.60	29.48	29.38	29.56.	29.99.	29.47.	9	19	19	16.66.	3 hours, 25 m.	0 29.	8
Tuesday,	" 25,	29.55	29.70	29.78				11	25	19				
Wednesday,	" 26,	29.99	29.95	29.97				21	33	25				
Thursday,	" 27,	29.90	29.47	29.80				20	29	28				
Friday,	" 28,	29.57	29.47	29.52				31	35	19				
Saturday,	" 29,	29.68	29.73	29.70				5	7	2				
Sunday,	" 30,	29.85	29.92	29.94				-12	1	-5				

In the JOURNAL for Dec. 27th, the figures indicating the height of the thermometer at 9, P.M., on the 13th, should read -2 instead of 2; and on the 14th, at 7, A.M., -6 instead of 6: the former representing below zero, and the latter above.

COMMUNICATIONS RECEIVED.—Cases of Diphtheria.

DEATHS IN BOSTON for the weeking Saturday noon, January 5th, 1861, 77. Males, 38—Females, 39.—Accidents, 3—apoplexy, 2—asphyxia, 1—inflammation of the bowels, 1—congestion of the brain, 1—disease of the brain, 2—inflammation of the brain, 3—bronchitis, 8—burns, 1—consumption, 14—convulsions, 2—croup, 1—cyanosis, 1—dropsy. 1—dropsy of the brain, 5—scarlet fever, 4—typhoid fever, 3—disease of the heart, 2—congestion of the lungs, 2—inflammation of the lungs, 3—marasmus, 1—old age, 1—paralysis, 1—premature birth, 3—scrofula, 1—scurvy, 1—teething, 1—tuberculosis, 1—unknown, 6—inflammation of the uterus, 1.

Under 5 years of age, 33—between 5 and 20 years, 9—between 20 and 40 years, 14—between 40 and 60 years, 16—above 60 years, 5. Born in the United States, 53—Ireland, 21—other places, 3.